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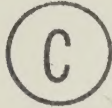
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A STUDY OF THE INCIDENCE, NATURE, AND CAUSE
OF HOCKEY INJURIES IN THE GREATER EDMONTON METROPOLITAN AREA

by



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A THESIS

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ABSTRACT

The purpose of this study was to investigate the incidence of hockey injury in the greater Edmonton metropolitan area and to examine the nature and causes of recorded accidents with the intent of reducing injuries in the future.

An accident report form was specifically designed for the study. The form was comprised of twenty-seven sections relating to information about the player, accident and injury information, information on the hockey rink and details on the time of the accident. The report form was designed to allow for computer analysis of all sections and factors.

Four hundred and forty-six accident report forms were received from 345 injured hockey players during the 1969-70 hockey season. Sixteen per cent of the injured players sustained more than one reportable injury during the hockey season.

The injury rate of hockey players in the greater Edmonton metropolitan area during the 1969-70 hockey season was 5.01 per cent which was greater than the rate reported in the majority of the hockey injury studies. The incidence of injury generally tended to increase as the players became older and increased in physical stature.

The wingmen and centres received 60 per cent of the total injuries. The face sustained 51 per cent of the total injuries. The facial region incurred 93 per cent of the lacerations. Lacerations near the eye were found to be the most common injury in all of the age groups surveyed.

The hockey stick was the major cause of injuries and accounted for 33 per cent of the total injuries. Ninety-one per cent of the abrasions and 59 per cent of the teeth injuries were caused by the hockey stick.

In 52 per cent of the head injuries (excluding the face), the players incurring the injuries were not wearing helmets. Nearly all of these injuries were to goalkeepers.

Eighty-eight per cent of the players who suffered concussions were wearing hockey helmets. The major causes of concussions resulted from the hockey stick and collisions with the boards.

In 90 per cent of the accidents where teeth injuries were involved the injured player was not wearing a mouth protector. In 27 per cent of the accidents where shoulder injuries were involved the injured player was not wearing shoulder pads.

Sixty-two per cent of the players sustained an injury during the second one-half of a shift. Forty-two per cent of the concussions were during the last one-quarter of the season. Eighty-three per cent of the sprains were sustained during the second or third periods. Seventy-eight per cent of the muscle strains occurred during the second one-half of the shift.

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CHAPTER I

STATEMENT OF THE PROBLEM

Introduction

The least decade has shown an increased interest and participation in sports. This increase has been the result of a shorter work week, which has increased leisure time, and a growing awareness of the value of recreational activities in the pursuit of physical fitness. Due to the increased demand to provide more activities and more facilities, one of the primary responsibilities which physical education and recreation people must continue to face is that of providing sports' participants with optimum protection against the accident hazards to which they might be exposed (1).

When individuals participate in vigorous sporting activities there is always the possibility that the participants will incur an injury. There is risk of injury, but the incidence of injury in many sports is small in relation to the number of participants. The very nature of competition is a challenge that often makes the sport appealing to the participant. Seaton (2) has found that sports injuries can be significantly reduced without depriving active games of the challenge that promotes participation. Effectively lowering the incidence of sports injuries without removing the innate challenge of the game has become an important goal for the fields of physical education and recreation.

Ice hockey has been called, "the fastest and most exciting game in the world" (3:67), and is one of Canada's major sports. During the last thirty-five years there have been many changes in the game. Hockey techniques have improved, players are larger in stature, are skating faster and more body contact is prevalent. Great improvements in equipment have evolved through the combined efforts of sporting goods manufacturers, coaches, physical education and recreation personnel (4). Although the protective equipment has improved, injuries still continue to occur at a rate as high as 34.4 per 1,000 participants (5). Most of the injuries in hockey are of a minor nature (1).

The Problem

The purpose of this study was to determine the incidence of hockey injuries within the greater Edmonton metropolitan area, and to examine the nature and cause of all reported injuries so that recommendations could be made and directed at reducing the incidence of injuries in subsequent years.

Need for the Study

A comprehensive review of medical, physical education, recreation and athletic literature pertaining to the incidence, nature, and cause of athletic injuries, revealed a lack of survey research projects on hockey injuries. Dzenowagis (1:3) has stated that, "A comprehensive system of injury reporting and recording, with a subsequent analysis

and evaluation of the data is an invaluable tool for determining progress in accident prevention."

The lack of reliable facts on accidents and injuries is an apparent characteristic of many sports. The lack of information on athletic injuries has made it difficult to arrive at the direct and underlying causes of hockey injuries.

To combat the problems in accident prevention, Florio (6:36) has set up guidelines to follow. Florio has suggested:

1. a more sizable body of solid information must be obtained, before preventative measures can be developed,
2. an effective accident reporting system must be developed to provide factual information, and
3. there must be a concentrated effort to analyze information in accident reports.

To effectively determine the incidence of injury to hockey players, a survey and study of hockey injuries was needed.

From a review of the literature it was apparent that there was a need to develop a comprehensive accident report form for hockey injuries. Within the limitations of the study, such a form was developed which permitted computer analysis of the recorded information.

Delimitations

In carrying out the study, a number of restrictions were placed on the sample and the study. The delimitations were:

1. Only hockey players within the greater Edmonton metropolitan area were surveyed.

2. The collection of data for this study was delimited to the 1969-70 hockey season.

3. Only those hockey injuries requiring medical or dental attention and or loss of playing time of more than one period because of injury, were recorded.

Limitations

The study was limited by the following factors:

1. Only those players with reported injuries were surveyed.
2. The study was dependent upon the accuracy of reporting by the coach, manager, trainer or team doctor.
3. The study was limited by the scope of the accident report form.

Definitions

Accident. An unplanned event immediately caused by an unsafe act or a mechanical or physical hazard resulting in a reportable injury (2,6).

Cause. The reason for the occurrence of a hockey injury.

Incidence. The frequency of hockey injuries which occurred.

Injury. A reportable injury was one which required the injured participant to desist from the activity and absent himself for a period of time, or required either dental or medical attention (2).

Period. A period of hockey was that amount of time encompass-

ing one-third of a game of hockey and normally involves twenty minutes of hockey playing time.

Shift. A shift in hockey is a segment of playing time. It encompasses a variable amount of time from when a player leaves the players' box until his return.

REFERENCES

1. Dzenowagis, Joseph G. "College Sports-Accidents, Injuries". Safety Education, pp 3-5, March, 1962.
2. Seaton Don Cash, Herbert J. Stack, and Bernard I. Loft. Administration and Supervision of Safety Education. New York: The MacMillan Company, pp 212-327, 1969.
3. Janes, J.M. "Ice-Hockey Injuries". Clinical Orthopedics, 23:67-74, 1962.
4. Coventry, M.B. "Winter Sports Injuries". Journal-Lancet, 85:66-70, Feb. 1965.
5. Toogood, Ted, and W.G. Love. "Hockey Injury Survey". Journal of the Canadian Association for Health, Physical Education and Recreation, 32(2):20-3, Dec., 1965. Jan., 1966.
6. Florio, A.E. "Safety In Interscholastics and Intramural Athletics". Annual Safety Education Review, Sixth Annual: 27-36, 1967.

CHAPTER II

REVIEW OF THE LITERATURE

Many articles emphasizing the preventative aspects of injuries in hockey have been published. Most of these articles were based primarily on personal observations and personal opinions, rather than on information obtained from adequate surveys or experimental methods. In reviewing the literature only one study specifically related to hockey injuries was found. This study was conducted by Toogood and Love (1) from accident forms originally drawn up for insurance purposes.

The review of related literature has been organized under the following headings: incidence of injury, nature of injuries, possible causes of injury and recommendations from previous studies.

Incidence of Injury

The incidence of hockey injuries is not as high as one might assume considering the extremely fast, aggressive, and competitive nature of the sport. One reason for this is the protective equipment used, and another is the absorption of the forces of gravity by the sliding of the skates or body on the ice (2).

According to Thorndike (3), who conducted a study on sports injuries to university students at Harvard University over a seven year period, a total of 26 per cent of all students participated in winter sports and 15 per cent of these participants incurred injuries. Hockey had the highest incidence of injury of the four activities classified as

winter sports. Toogood and Love (1) reported that of the 2,469 players in the Toronto Township Hockey League eighty-five injuries were reported. The calculated incidence of injury for this study was 34.4 injuries per 1,000 players. Dzenowagis (4) reported that the incidence of injury in ice skating and hockey, in the Mens' Physical Education activities at Michigan State University over a five year period, was 9.1 per 1,000 participants. In the same study, the Mens' Intramural program injury rate per 1,000 participants was 24.5, and 55.6 per 10,000 exposures. This was the highest of any intramural activity. The highest incidence of hockey injury was fifty-two injuries from a total of 180 players which resulted in an incidence of 290.2 per 1,000 participants. This figure came from an eight year study by Clark (5) on sports injuries in a Massachusetts secondary school. Hockey ranked fifth in injuries among the sports played. Snook (6), utilizing data collected in a two year survey on injuries incurred in the four major sports at the University of Massachusetts, found that hockey ranked second in frequency of injury. It was also reported that the frequency of hockey injuries remained relatively constant from year to year (5,6).

Pechar (7) reported that hockey ranked third, behind six and eleven man football, when measured by frequency of accidents per 1,000 pupil exposures, in the accidents in athletics incurred in the secondary physical education programs of the State of New York. In order of severity of injuries (as measured by days lost per 1,000 pupil exposures)

Pechar reported that hockey again ranked third. White (8) found that for the twelve to fourteen year old players, over 40 per cent had received some sort of injury during the season. In a study by Mendryk and Dickau (9) of accidents which occurred during athletic and physical education activities in the Edmonton Public School System, hockey ranked sixth in the total number of accidents in high schools accounting for 4.4 per cent of the total accidents. In the same study hockey ranked sixteenth in the junior high schools with .17 per cent of the accidents, and tenth in the elementary schools with 1.6 per cent of the accidents. These figures for the Edmonton system tend to reflect participation in hockey at these three levels rather than the incidence of hockey injuries as compared to other physical education activities.

Nature of Injuries

Coventry (2:67) has stated that: "the ice hockey injuries one sees today are not much different from those seen thirty years ago. While there is more body contact in the game today, the protective padding is such that these two factors tend to neutralize one another." Head-gear is now mandatory for all amateur competitors up to junior hockey age and this helps to decrease serious head injuries. Another major advance in protective equipment is the attachment of the tendo-achillis protective pad to the back of the hockey boot. The use of a mask by the goalkeeper has decreased the incidence of facial injury. The Canadian Amateur Hockey Association have authorized their branches, at the discretion of their members, to make it compulsory for goalkeepers to wear approved

face masks (2,10).

In general most injuries in hockey appear to be lacerations to the facial area (2,4,11). Blackburn (12) has stated that more than one-half of all hockey injuries occur in the general area of the mouth. Insurance statistics have shown that approximately 50 per cent of claims are for the repair of teeth (13).

A summary of the most frequently injured areas of the body as reported by Toogood and Love (1) is presented in Table I.

TABLE I
FREQUENCY OF INJURY TO BODY REGION
IN THE TORONTO TOWNSHIP HOCKEY LEAGUE
DURING THE 1964-65 HOCKEY SEASON

Body Area Injured	Percentages
mouth and teeth	25.4
eye and/or area around eye	14.5
nose	9.7
knee	8.4
head	7.2
wrist	6.0
chin	4.8
ribs, ankle, fingers	10.8
forehead	3.6
chin, thumb, neck	7.2
pelvis, toes	2.4

The number of accidents to the face and head in the study by Toogood and Love (1) was 67.5 per cent, while the rest of the body incurred

only 32.5 per cent of the injuries.

White (8) observed that the head and teeth incurred 58 per cent of the injuries while the neck and body received 42 per cent of the injuries. In the survey by Dzenowagis (4) in the College Mens' Intramural Program, the results were, 57.5 per cent of the total hockey injuries were to the head and face and 42.5 per cent of the injuries were to the remainder of the body. A summary of body areas injured in the study reported by Dzenowagis is given in Table II.

TABLE II
PARTS OF THE BODY INJURED IN THE MENS' INTRAMURAL
HOCKEY PROGRAM AT MICHIGAN STATE UNIVERSITY
DURING THE 1955-60 SEASONS

Body Area Injured	Percentages
knee	12.1
face	21.2
ankle	6.1
eye	30.3
head or scalp	3.0
shoulder	3.0
finger	9.1
leg or foot	3.0
arm or hand	3.0
back or trunk	6.1
mouth	3.0

An analysis of injuries in the survey conducted by Kelly (14) on students at the University of Alberta, is given in Table III. The

data (14) revealed that 28.5 per cent of the injuries were to the head area while 52 per cent of the injuries were to the legs and groin area.

TABLE III
PARTS OF THE BODY INJURED BY INTRAMURAL AND
VARSITY HOCKEY PLAYERS AT THE UNIVERSITY OF ALBERTA
DURING THE 1967-68 SEASON

Body Part Injured	Percentages
knee	14.0
groin	12.0
face	14.0
shoulder	12.0
ankle	9.5
head	9.5
thigh	7.0
foot	7.0
elbow	5.0
teeth	5.0
back, chest, and lower leg	7.0

The most common injuries in hockey according to Coventry (2) are soft tissue injuries. The most common of the soft tissue injuries are lacerations about the face and tendo-achillis, muscle contusions, sprains and strains. The less common soft tissue injuries include arterial injuries that may occur at the wrist, groin, or along the leg, ruptured viscera, cerebral injury and traumatic bursitis.

Skeletal or bony injuries which tend to occur in hockey are fractures of facial bones, clavicle, skull, spine, ribs, bones of the leg

or thigh and acromioclavicular separations. Injuries to the face are perhaps the most common of all hockey injuries. The most common are acromioclavicular separations. Sternoclavicular separations occur infrequently (2).

The types of injuries as recorded by Dzenowagis (4) for ice hockey injuries were as indicated in Table IV.

TABLE IV
TYPES OF INJURIES INCURRED IN THE MENS'
INTRAMURAL HOCKEY PROGRAM AT MICHIGAN STATE UNIVERSITY
DURING THE 1955-60 SEASONS

Type of Injury	Percentages
contusions	15.2
cuts	66.7
strains	9.1
dislocations	3.0
teeth broken or knocked out	3.0
fractures	3.0

The types of injuries as recorded by Kelly (14) for ice hockey are reported in Table V.

In the survey by Kelly (14), the area of injury was related to the type of injury. It was found that the head and face were prone to lacerations and the groin to strains, followed by muscle contusions to the shoulder and thigh and fractures to the face.

The type of injuries recorded by Clark (5) for ice hockey injuries

over an eight year period were as set out in Table VI.

TABLE V

TYPES OF INJURIES INCURRED BY INTRAMURAL AND
VARSITY HOCKEY PLAYERS AT THE UNIVERSITY OF ALBERTA
DURING THE 1967-68 SEASON

Type of Injury	Percentages
lacerations or incisions	19.0
muscle bruise	19.0
sprain	19.0
muscle strain	15.5
fracture	9.5
bone and joint bruise	10.0
teeth	5.0
concussion	2.5
dislocation/separation	2.5

Snook (6) classified the University of Massachusetts varsity and freshman hockey team injuries into major and minor headings. The minor injuries were those classified as not entailing loss of time from hockey. The major injuries were those that entailed the loss of at least one day of hockey and were categorized under four headings which were; head, shoulder, neck, and knee. The types of injuries as recorded by Snook are set out in Table VII.

Snook (6:117) has stated that, "if one includes injuries to the face as injuries to the head, hockey actually leads all other sports, including football, in the number of head injuries."

Possible Causes of Injury

Hockey injuries may be caused by a combination of factors.

According to Toogood and Love (1) the most common causes of injury are as outlined in Table VIII.

TABLE VI

TYPES OF INJURIES INCURRED BY HOCKEY PLAYERS
AT PHILLIPS ACADEMY, ANDOVER MASSACHUSETTS
DURING THE 1956-63 SEASONS

Type of Injury	Percentages
contusions	32.3
lacerations	18.4
strains	18.2
abrasions	11.5
sprains	9.3
fractures	8.6
concussions	1.7
dislocations	0.0

The survey by Kelly (14) was analyzed in a slightly different manner but yielded similar results, as shown in Table IX.

In the Toogood and Love (1) study, when the type of injury was related to the cause, it was found that 94 per cent of the hockey stick injuries were to the head or face, 85 per cent of the puck injuries were to the head or face, 100 per cent of the skate injuries were to the head and face, 82 per cent of the injuries resulting from being "checked" and 70 per cent of the injuries, resulting from trips or fall, were to the limbs or trunk.

The survey by Kelly (14) showed that 60 per cent of the head and face injuries were the result of collision with an object or body contact, while one-half of the knee injuries were due to accidental collisions. Other conclusions drawn from the Kelly data were that muscle contusions were mainly the result of a blow from an object, and muscle sprains were the result of falls or trips.

TABLE VII
TYPES OF INJURIES INCURRED BY HOCKEY PLAYERS
AT THE UNIVERSITY OF MASSACHUSETTS
DURING THE 1965-67 SEASONS

Type of Injury	Percentages
minor injuries	92.4
major injuries	
a. head	3.6
b. shoulder	2.2
c. neck	1.3
d. knee	0.5

Toogood and Love (1) studied the relationship of age to the frequency of injury. It was found that 44 per cent of the injuries occurred to players between the ages of nine and thirteen and the remaining 56 per cent of the injuries to players between the ages of fourteen and eighteen. The most common ages for injury were fourteen and fifteen accounting for 29 per cent of the total accidents. In the same study when the type of injury was related to the ages of the players it was found that between the ages of nine to thirteen inclusive, 77 per cent of the injuries

were to the head and face, but between the ages of fourteen to eighteen inclusive, the head and face injuries had dropped to 52 per cent.

TABLE VIII
CAUSES OF HOCKEY INJURIES IN THE TORONTO TOWNSHIP
HOCKEY LEAGUE DURING THE 1964-65 SEASON

Cause of Injury	Percentages
hockey stick	20.5
puck	15.7
boards	14.5
skate	7.2
checked	13.3
fell	12.1

Toogood and Love (1) also investigated the frequency of injury within the various months of the hockey season. It was found that between the months of October to April inclusive, the most common month for accident occurrence was February with 26 per cent of the accidents followed by December and March with 14 per cent of the accidents in each month.

There are many causes of hockey accidents for which no statistics are available but which should be recorded. The hockey stick and puck seem to cause the majority of injuries to the unpadded portions of the body. The most common injuries are lacerations, contusions and fractures about the face, head and neck, and injuries to the teeth. These are due to the lack of protection of the face and the predominance of missile

injuries, either guided or unguided, namely pucks, sticks and fists.

The larynx is sometimes hit by the puck or a stick, as are the upper and lower arms which are prone to bone and muscle contusions. Other injuries caused by the puck or stick are chip and crack fractures of the tibia. Puck injuries are principally wounds of the incised type when the blow is glancing, but when straight contact occurs, stellate flesh wounds result, and on occasion, depressed fractures in the temporal area may occur. The medial anterior thigh is subject to muscle contusions by the puck. Especially prone to this type of injury are goalkeepers and defense-men who are hit in the less protected area of the pants. Injuries caused specifically by the stick are fractured ribs or fractures of the lower end of the fibula from a direct blow across the lateral aspect of the ankle. Fractures of the metacarpals and scaphoid occur occasionally. These are caused by illegal chopping of a players stick on the opponents glove (6,11,13,15,16,17).

The injury of the player against the boards, goal post, or ice, may be quite serious and includes cerebral concussion and injuries to the cervical spine which almost invariably result from boarding and not from contact with the ice. The more serious neck injuries appear to occur to the player who is forced into the boards with his head and shoulders striking the boards. Fractures of the olecranon and clavicles, charley horse, knee injuries, sprains and strains are a result of forcible collision with the boards and ice. Collisions with goal posts may result in serious injuries such as kidney ruptures and fractures as well as

sternoclavicular separations (2,6,11,15).

Skates are less commonly a cause of injury than one might assume, but when skate injuries do occur they are usually of a serious nature such as lacerations of the scalp, tendons, nerves, blood vessels and the biceps (2,11,15).

TABLE IX
CAUSES OF INJURY INCURRED BY INTRAMURAL AND
VARSITY HOCKEY PLAYERS AT THE UNIVERSITY OF ALBERTA
DURING THE 1967-68 SEASON

Cause of Injury	Percentages
blow from an object	21.5
body contact	19.0
accidental body collision	19.0
collision with an object (not an obstruction)	16.5
fall or trip not due to an external factor	12.0
fall or trip due to an inadequate feature of the playing area	12.0

Body contact produces many injuries in hockey including ligament sprains, knee cartilage injuries, muscle strains, contusions, fractures and even ruptured viscera. Fighting causes contusions and sometimes eye injuries (2,11).

Stress factors and spectators also cause their share of injuries. Undue effort on the part of a player can cause stress fractures, torn ligaments and tendons, and muscle rupture. Spectators who litter the

ice with small foreign bodies, as well as throwing larger objects that may hit and injure players, or may cause players to trip and injure themselves (2,15).

Recommendations From Previous Studies

Toogood and Love (1) made recommendations for the reduction of hockey injuries. There were two approaches to the formulation of recommendations. The first centred on protection of the player against injury, and the second focused attention upon avoidance or reduction of the cause of injury. Toogood and Love have suggested that there be an improvement in the style of the helmet. Since most of the injuries occur to the head and face, they suggest that a suitable protective device be placed across the face of the helmet. To further decrease head injuries and possible death to a hockey player, Fekete (16) has suggested that a better helmet be designed to cover the temporal area; a helmet that absorbs or distributes a heavy blow to the head much as a football helmet does. Clark (5) reported that a prototype full suspension helmet was worn by the hockey players he surveyed and resulted in the elimination of concussions. Clark also found that the straps which covered the chin and kept the helmet in place reduced lacerations of the face and forehead by approximately 50 per cent.

Many injuries occur to the teeth. It has been suggested by Blackburn (12) that the use of the mouth guard be made compulsory in

hockey as protection against the fracture of teeth. Clark (5:28) has stated that:

Ten years ago hockey produced more injuries to the teeth at Phillips Academy than any other sport. Since 1961, hockey players have been encouraged to wear mouthguards. Until recently, these mouthguards were uncomfortable and unsightly and boys would consciously or unconsciously lose them as fast as their parents had them manufactured. Recently a new light malleable, transparent mouthguard, made and fitted by our dental department, has been introduced and so far none of these have been discarded. More importantly, during the last three years, no boy who has worn his mouthguard has suffered injury to his teeth.

Since the causes of most facial hockey injuries are the puck, stick, and skate, it has been suggested by Toogood and Love (1) that a rule be changed so that the stick must be carried below the waist, and that the slap shot be outlawed since the stick comes too far off the ice. Toogood and Love have suggested that a rubber or plastic guard be placed on the upper edge of the stick as is mandatory for the back of the skate blades (10).

Toogood and Love (1) have also suggested a greater enforcement of the rules and a stiffer penalty for checking and hitting on the boards since a large proportion of the injuries occur at or near the boards. Clark (5) remarks that some hockey officials tend to ignore some of the most flagrant rule breaking which leads to injuries that occur through this breach of their duties. Clark has observed that the ignoring of flagrant rule infractions is especially true of those rules which pertain to illegally riding an opposing player into the boards.

REFERENCES

1. Toogood, Ted. and W.G. Love. "Hockey Injury Survey". Journal of the Canadian Association for Health, Physical Education and Recreation, 32(2): 20-3, Dec., 1965. Jan., 1966.
2. Coventry, M.B. "Winter Sports Injuries". Journal-Lancet, 85:66-70, Feb. 1965.
3. Thorndike, A. Athletic Injuries Prevention, Diagnosis and Treatment, Philadelphia: Lea & Febiger, pp. 60-3, 1948.
4. Dzenowagis, Joseph G. "College Sports-Accidents, Injuries". Safety Monograph No. 15, Chicago: National Safety Council, 1962.
5. Clark, D.M., "Some Medical Aspects of Precollege Sports for Boys". Proceedings of the Sixth National Conference on the Medical Aspects of Sports, 24-30, 1964.
6. Snook, G.A., "Head and Neck Injuries in Contact Sports". Medicine and Science in Sports, 1(3): 117-123, 1969.
7. Pechar, Stanley F., "Accidents in Secondary School Physical Education Programs". Annual Safety Education Review, 2nd Edition:34-7, 1963.
8. White, C.A. Letter to the Writer, 6 March, 1967.
9. Mendryk, Stephen, and G.W. Dickau. "The Incidence of Injury in Athletic and Physical Education Activities in the Edmonton Public School System". Unpublished paper presented at the Annual Meeting of the Canadian Association of Sports Sciences, Toronto, Ontario, March 16, 1968.
10. Canadian Amateur Hockey Association. 1968-69 Official Rule Book of the Canadian Amateur Hockey Association. Toronto: Crown Life Insurance Company, p 25, 1968.
11. Scott, John. "Ice Hockey and Its Hazards". Medical World, 90:273-4, 1959.
12. Blackburn, M.M. "One-Year Evaluation of Twelve Mouth Protectors for Edmonton Hockey Players". The Canadian Dental Association Journal, 30: 560-4, 1964.
13. Elliott, A.C. Letter to the Writer, 12 February, 1969.

14. Kelly, R., and John S.H. Reeves. "A Survey of Hockey Injuries at The University of Alberta During the 1967-68 Hockey Season". Unpublished Materials, 1969.
15. Janes, J.M. "Ice-Hockey Injuries". Clinical Orthopedics, 23:67-74, 1962.
16. Fekete, John F. "Severe Brain Injury and Death Following Minor Hockey Accidents". Canadian Medical Association Journal, 99:1234-8, Dec. 28, 1968.
17. Campbell, J.S., P. Fournier, and D.P. Hill. "Puck Aneurysm". Canadian Medical Association Journal, 81:922-4, 1959.

CHAPTER III

METHODS AND PROCEDURES

Methods

A status survey technique was used to investigate the incidence, nature, and cause of hockey injuries in the Edmonton Metropolitan Hockey Association during the 1969-70 hockey season. Since a standardized accident report form did not exist on the incidence, nature, and cause of hockey injuries, one was designed with the help of related studies and knowledgeable people in the athletic injury, medical, and hockey fields.

The structure of the survey questionnaire was divided into five main areas. The first was information on the player which covered his physical characteristics, hockey skill and hockey experience. The second dealt with the accident and the hockey injury. The third considered the time of the accident. The fifth dealt with previous injuries, medical equipment, insurance and remarks. The survey form was designed so that the responses could be reduced to a numerical basis making them amenable for treatment by computer analysis. A sample of the accident form is present in Appendix A.

The cooperation of the Edmonton Metropolitan Hockey Association, the University of Alberta, and the Northern Alberta Institute of Technology was sought. The report forms were to be completed by either the

coach, manager or trainer of the teams involved in the study.

Prior to the 1969-70 hockey season the accident report forms were delivered to the coaches of the teams along with an instructional pamphlet. The pamphlet described the study, the importance of accurate reporting, and the procedures involved when filling out the form. A sample of the instructional pamphlet is presented in Appendix B. The investigator personally briefed each coach or team representative on the use of the form and the importance of the study. The responsibility for ensuring that the reports were completed was given to the coach.

Nature of the Sample

The sample included 624 'AA' and 4,611 'BB' male hockey players under the jurisdiction of the Edmonton Metropolitan Hockey Association. The sample also included 1,584 Intramural and thirty-four Varsity and Junior Varsity male hockey players from the University of Alberta. Nineteen Edmonton Junior and eighteen Northern Alberta Institute of Technology male hockey players were also included as part of the sample.

Procedures

The accident reports were completed by the manager, coach, trainer or team doctor as soon as possible after the occurrence of the accident. The report forms were then either mailed directly to the investigator by the coach or else given to the sports director for that particular team who in turn mailed the accident report forms to the

investigator.

To check the accuracy of reporting the investigator selected one in every five completed survey forms and phoned the injured hockey player in order to validate the information on the accident report form.

At the end of the hockey season the investigator contacted all of the hockey teams involved in order to ascertain whether all injuries that had occurred on the respective teams had been reported. If an individual injury had not been reported the investigator personally contacted the injured player to acquire the information needed to complete an accident report form.

The transfer of data from the reports to IBM cards began at the end of the hockey season. The cards were subsequently run through the computer under conditions designed to yield accumulations and causitive data. A description of the computer programs used in this study is presented in Appendix C.

CHAPTER IV

RESULTS AND DISCUSSION

Results were tabulated and analyzed by pooling the data obtained from all teams involved in this study.

The major factors to be discussed were the incidence of injuries, the injured players physical characteristics, hockey skill, hockey experience, nature of the injury, cause of the injury, place of injury on the ice playing surface, characteristics of the rink, time of the injury, previous injury, medical equipment, and insurance.

Incidence

During the 1969-70 hockey season the nature and incidence of injury occurring to hockey players of the greater Edmonton metropolitan area were recorded and analyzed. Of the total sample of 6,890 participants, 345 players were reported injured. The calculated incidence of hockey injury was 50.1 per 1,000 hockey players, or 5.01 per cent. Of the injured hockey players some 16 per cent suffered more than one injury during the 1969-70 hockey season. The total number of accident report forms received was 446. Table X represents a summary of the calculated incidence of hockey injury in the various leagues.

The tables to follow are comprised of data from the total sample of injured hockey players.

In Table X the Edmonton Metropolitan Hockey Association (EMHA)

'AA' was comprised of Juvenile, Midget and Bantam levels of hockey.

The EMHA 'BB' was comprised of Juvenile, Midget, Bantam, Pee Wee and Mite levels of hockey. The Intramural University of Alberta category was comprised of an upper, intermediate and lower division. The Inter-collegiate category was comprised of junior and varsity teams.

TABLE X

INCIDENCE OF HOCKEY INJURIES IN THE GREATER
EDMONTON METROPOLITAN AREA DURING THE 1969-70 SEASON

Level	No. of teams	No. of participants	No. of injuries	Calculated incidence per 1000 participants
EMHA 'AA '	39	624	120	161.9
EMHA 'BB '	306	4611	170	33.4
Intramural (U. of A.)	112	1584	45	28.4
Junior	1	19	6	315.8
NAIT	1	18	10	555.6
Intercollegiate	2	34	95	852.9
Totals	461	6890	446	

Age

Table XI reflects the calculated incidence of hockey injuries of the age groups in the various divisions studied. The age range for a Mite hockey player was ages eight to ten years inclusive, Pee Wee ages eleven and twelve, Bantam ages thirteen and fourteen, Midget ages fifteen and sixteen and Juvenile ages seventeen and eighteen. The 'AA' suffix represents a more advanced playing category and also signifies more games played

per season than does the 'BB'.

The category titled "Others 18 and over" was comprised of Intramural, Junior, Northern Alberta Institute of Technology (NAIT) and the two Intercollegiate teams. The players of these teams were eighteen years of age or older.

TABLE XI
AGE AND DIVISION RELATED TO INCIDENCE OF INJURY IN
THE GREATER EDMONTON METROPOLITAN AREA
DURING THE 1969-70 SEASON

Group	No. of teams	No. of participants	No. of injuries	Calculated incidence per 1000 players
Bantam 'AA'	23	368	51	116.8
Midget 'AA'	9	144	35	208.3
Juvenile 'AA'	7	112	34	250.0
Mite 'BB'	104	1560	26	15.4
Pee Wee 'BB'	94	1410	37	24.1
Bantam 'BB'	68	1020	30	26.5
Midget 'BB'	33	495	41	74.7
Juvenile 'BB'	7	126	36	254.0
Bantam 'AA' + 'BB'	91	1388	81	50.4
Midget 'AA' + 'BB'	42	639	76	104.9
Juvenile 'AA' + 'BB'	14	238	70	252.1
Others 18 and over	116	1655	156	54.4

The laceration around the eye was the most common injury in all age groups. Of the total injured in the nine and under age group, 33 per cent received eye lacerations, 20 per cent cheek lacerations and 20

per cent bone bruises to the elbow. For the ten and eleven year old age groups, 25 per cent sustained eye lacerations, 9 per cent received mouth lacerations and 9 per cent incurred teeth injuries. Of the total injured in the twelve and thirteen year old age group, 13 per cent received eye lacerations and 13 per cent incurred teeth injuries. For the fourteen and fifteen year old age group, 16 per cent sustained eye lacerations, while 13 per cent received mouth lacerations and 9 per cent incurred teeth injuries. Of the total injured in the sixteen and seventeen year old age group, 11 per cent sustained eye lacerations, 7 per cent received jaw lacerations, 7 per cent incurred nose fractures and 7 per cent sustained shoulder fractures. For the eighteen and nineteen year old age group, 9 per cent received eye lacerations and 7 per cent incurred mouth lacerations. Of the total injured in the twenty to twenty-five year old age groups, 8 per cent sustained eye lacerations, 7 per cent incurred mouth lacerations and 5 per cent received forehead lacerations. Of the two injuries to the twenty-six to thirty age group one was a forehead laceration and the other was a tooth injury. No injuries were reported in the over thirty-one years sections of the report form.

Previous Hockey Playing Experience

The categories used for classifying previous hockey playing experience were: first year, one year, two years, three to five years, six to ten years and eleven years and over.

Forty-three per cent of the injuries were sustained by hockey players with six to ten years of hockey playing experience. This group sustained 73 per cent of the fractured shoulders, 70 per cent of the nose fractures, 70 per cent of the knee strains, 60 per cent of the nose fractures and 64 per cent of the teeth injuries.

The hockey players with three to five years of hockey playing experience incurred 27 per cent of the reported injuries and sustained all of the fractured lower arms, 75 per cent of the bone contusions to the nose and 67 per cent of the bone bruises to the cheek.

Hockey players with eleven or more years of hockey playing experience received 23 per cent of the hockey injuries and sustained all of the bone contusions to the shoulder, 67 per cent of the muscle strains to the shoulder and 67 per cent of the muscle contusions to the lower arm.

Seven per cent of the hockey injuries were incurred by hockey players with two years or under of hockey playing experience.

Skill Level

The hockey coaches were asked to assess the injured players hockey skill relative to the team average. Seventy-four per cent of the injured players were rated on the upper one-half of the team in skill while 26 per cent were classified on the lower one-half of the team in skill.

Participation in Other Sports

Eighty-two per cent of the injured hockey players did not partic-

ipate in other sports during the hockey season while 18 per cent participated in other athletic activities.

Position Playing When Injured

Table XII reveals the incidence of injuries according to position played.

TABLE XII
POSITION PLAYED
RELATED TO INCIDENCE OF INJURY

Position	Percentage of Total Injuries
left defense	17.0
right defense	16.8
left forward	20.4
right forward	18.6
centre	21.3
goal	5.8

The forwards and centres received 60 per cent of the injuries while the defensemen and goalkeepers sustained 40 per cent of the total hockey injuries. The eye laceration was the most common injury among all the positions except for the centre and goalkeeper where mouth lacerations and head injuries (excluding the face) were the most common.

The left forwards sustained all of the reported hand fractures and 50 per cent of the shoulder muscle strains. Fifty per cent of the muscle contusions to the front of the thigh were to the right defensemen. Left forwards sustained 67 per cent of the ankle and 45 per cent of the

shoulder fractures. Fifty per cent of the shoulder dislocations, 47 per cent of the jaw lacerations and 50 per cent of the ankle sprains were sustained by the centre-forward. Goalkeepers incurred 86 per cent of the total head lacerations, excluding lacerations to the face.

At the time of injury, 92 per cent of the injuries were to hockey players who were playing their regular position while 8 per cent were to players playing positions other than their regular position.

Body Region Injured

Table XIII provides an analysis of injuries by body region. The head was the site of 56 per cent of the total injuries with the face accounting for 51 per cent of the total injuries. The upper body, comprised of the region from the neck to the groin, accounted for 26 per cent of the total injuries. The lower body region accounted for 18 per cent of the total injuries. No injuries to the achillis tendon were reported.

Type of Injury

Table XIV depicts the percentages of the various types of hockey injuries incurred. From Table XIV, those injury categories that contained percentages greater than ten, are discussed below.

Lacerations

Ninety-three per cent of the lacerations were to the facial area. Of this total 37 per cent of the lacerations were to the eye, 21 per cent to

the mouth, 11 per cent to the jaw and 10 per cent were to the forehead.

Fractures

Nineteen per cent of the fractures were to the shoulder, 19 per cent to the wrist, 18 per cent to the nose, 12 per cent to the hand and 11 per cent of the fractures were to the ankle.

TABLE XIII

INCIDENCE OF INJURY RELATED TO BODY REGION

Body Region Injured	Percentage of Total Injuries
head (excluding face)	4.7
forehead	4.5
eye	13.7
nose	8.1
cheek	4.3
mouth	16.4
jaw	3.8
neck	.9
shoulder	7.4
chest	1.8
upper back	.7
lower back	1.3
upper arm	.4
elbow	.7
lower arm	2.5
wrist	3.6
hand	4.9
abdomen	.7
hip	1.6
genital	.2
buttocks	.2
groin	.7
thigh (front)	2.2
upper leg (rear)	.4
knee	7.4
lower leg (front)	1.3
calf	.4
ankle	4.7
foot	.7

Bone Bruises

The bone bruise injuries incurred were generally distributed over all the body regions. Thirteen per cent of the bone bruises were to the ankle, 11 per cent to the chest, 9 per cent to the nose, 9 per cent to the hip and 9 per cent to the hand.

TABLE XIV
INCIDENCE OF INJURY
RELATED TO TYPE OF INJURY

Type of Injury Sustained	Percentage of Total Injuries
laceration	34.8
fracture	12.8
bone bruise	10.5
muscle bruise	9.0
teeth	8.7
sprain	6.5
muscle strain	6.1
concussion	4.3
dislocation	3.6
abrasion	2.5
nose bleed	1.3
frost bite	0.0

Cause of Injury

The causes of hockey accidents that resulted in injury are presented in Table XV.

A blow from a hockey stick caused 91 per cent of the abrasions, 59 per cent of the teeth injuries, 46 per cent of the lacerations, 32 per cent of the concussions, 28 per cent of the bone bruises and 25 per

cent of the muscle bruises. Being struck by the puck caused 28 per cent of the lacerations, 28 per cent of the bone bruises and 23 per cent of the muscle bruises. Forty one per cent of the sprains, 38 per cent of the dislocations, 32 per cent of the fractures and 26 per cent of the concussions occurred in the immediate vicinity of the boards and screen used to enclose the perimeter of the playing surface.

TABLE XV

CAUSES OF INJURY RELATED TO INCIDENCE OF INJURY

Cause of Injury	Percentage of Total Injured
stick	32.7
puck	17.7
boards (including glass or screen)	15.9
bodycheck	12.1
accidental collision between players	7.4
fall or trip	5.8
skate	3.6
fight	2.5
goal post	1.8
faulty equipment (inadequate)	0.2
ice litter	0.2

League

The incidence of injury of the various divisions of hockey was presented in Tables X and XI.

The Mite level hockey players sustained 6 per cent of the total injuries but incurred 22 per cent of the total mouth lacerations and 11 per cent of the total eye lacerations. Thirty-one per cent of the

injuries to Mite hockey players were caused by the puck, 31 per cent were caused by the stick, 15 per cent resulted from contact with boards and 15 per cent resulted from accidental collisions.

The Pee Wee level hockey players incurred 8 per cent of the total injuries but sustained 21 per cent of the total teeth injuries and 14 per cent of the total eye lacerations. Thirty eight per cent of the injuries to Pee Wee hockey players were caused by the puck, 30 per cent by the stick and 19 per cent were a result of a collision with the boards.

The Bantam level hockey players sustained 18 per cent of the total injuries, 11 per cent of these were to the 'AA' Bantams and 7 per cent to the 'BB' Bantams. Bantam hockey players incurred 39 per cent of the total mouth lacerations, 36 per cent of the total shoulder fractures, 27 per cent of the total wrist fractures and 27 per cent of the total eye lacerations. For the Bantam level the majority of the shoulder fractures and mouth lacerations were incurred by the 'AA' Bantams while the majority of the eye lacerations were sustained by the 'BB' Bantams. The wrist fracture injuries were divided evenly between the two leagues. Thirty three per cent of the injuries to Bantam hockey players were caused by the hockey stick, 21 per cent by the puck, 12 per cent as a result of a collision with the boards and 11 per cent were caused by a bodycheck. The majority of the injuries caused as a result of a collision with boards and by bodychecks were sustained by 'AA'

Bantams whereas the stick and puck injuries were divided evenly between the two Bantam leagues.

Seventeen per cent of the total injuries were incurred by Midget hockey players, 8 per cent of these were sustained by the 'AA' Midgets and 9 per cent were incurred by the 'BB' Midgets. Midget hockey players sustained 57 per cent of the total hand fractures, 42 per cent of the total concussions, 40 per cent of the total shoulder dislocations, 31 per cent of the total nose lacerations, 27 per cent of the total shoulder fractures and 27 per cent of the total cheek lacerations. The types of the injuries to Midget players were divided evenly between the 'AA' and 'BB' Midget leagues. Twenty-two per cent of the injuries to Midget hockey players were caused by the stick, 20 per cent by bodychecks, 17 per cent as a result of a collision with the boards and 14 per cent by the puck. The majority of the bodycheck injuries occurring to Midget hockey players were to the 'AA' Midgets while the 'BB' Midgets sustained the majority of injuries as a result of a collision with the boards. The stick and puck injuries were divided evenly between the two Midget leagues.

The Juvenile level hockey players sustained 16 per cent of the total reported hockey injuries. Each of the 'AA' and 'BB' Juvenile leagues sustained 8 per cent of the total injuries. Juvenile hockey players incurred 40 per cent of the total nose fractures, 27 per cent of the total shoulder fractures, 27 per cent of the total cheek lacera-

tions, 27 per cent of the total wrist fractures, 18 per cent of the total jaw lacerations and 18 per cent of the total teeth injuries. The majority of the shoulder fractures and teeth injuries were incurred by the 'AA' Juveniles while the majority of the nose and wrist fractures were sustained by the 'BB' Juveniles. The jaw and cheek laceration injuries were divided evenly between the 'AA' and 'BB' Juveniles. Thirty three per cent of the injuries to Juvenile hockey players were caused by the hockey stick, 19 per cent as a result of a collision with the boards and 14 per cent by bodychecks. The above causes of hockey injuries to Juveniles were divided evenly between the 'AA' and 'BB' leagues.

Twenty-five per cent of the reported hockey injuries were incurred by Intercollegiate hockey players. The Intercollegiate category consists of the Varsity and Junior University of Alberta teams, the Northern Alberta Institute of Technology team and one Junior team. In the Intercollegiate category, hockey players sustained 67 per cent of the total lower arm muscle contusions, 63 per cent of the total muscle contusions to the front of the thigh, 50 per cent of the total shoulder dislocations, 50 per cent of the total muscle strains to the shoulder and 40 per cent of the total muscle strains to the knee. Forty per cent of the injuries to Intercollegiate players were caused by the hockey stick, 14 per cent were caused as a result of a collision with the boards, 14 per cent were caused by bodychecks, and 13 per cent were caused by the puck.

The University of Alberta Intramural hockey players incurred 10 per cent of the total injuries. Intramural hockey players incurred 40 per cent of the total forehead lacerations, 23 per cent of the total nose lacerations, 13 per cent of the total eye lacerations, 13 per cent of the total teeth injuries and 12 per cent of the total mouth lacerations. Of the injuries to Intramural hockey players 36 per cent were caused by the hockey stick, 18 per cent as a result of a collision with the boards, 16 per cent by the puck, 11 per cent by bodychecks and 11 per cent by accidental collisions.

Penalty on Play

Penalties were not assessed on 85 per cent of the reported injuries. Penalties were assessed to non-injured players in 11 per cent of the injuries and were assessed to the injured player in 4 per cent of the total injuries.

Equipment

The coach was asked to indicate on the survey form the equipment that was not worn by the injured player when the accident occurred. An analysis and discussion of equipment related to the incidence and type of injury incurred is presented below.

Helmet

In 52 per cent of the head injuries (excluding the face) the players incurring the injuries were not wearing helmets. Seventy-three

per cent of the above injuries were to goalkeepers and the remaining 27 per cent were to left forwards. The left forward injuries occurred during supervised practices. Seventy-three per cent of the above injuries were caused by the puck, 9 per cent by the hockey stick, 9 per cent by a fall or trip and 9 per cent by an accidental collision. Eighty-two per cent of the injuries to players who were not wearing helmets were lacerations and 18 per cent were concussions.

Eighty-eight per cent of the players who suffered concussions were wearing helmets. The blow which caused the concussion was either to the head (excluding the face) or the forehead. The concussions were caused as a result of a collision with the boards in 38 per cent of the cases, by the stick in 28 per cent of the cases and in 17 per cent of the cases by a bodycheck.

Mouth Protector

In 90 per cent of the accidents where teeth injuries were involved the injured hockey player was not wearing a mouth protector. Fifty-nine per cent of the injuries to teeth were caused by the hockey stick, 15 per cent by bodychecks, 13 per cent by pucks and 8 per cent were caused by accidental collisions.

Ankle Guards

In all of the reported injuries where a player was hit on the ankle with a stick or a puck the player was not wearing ankle guards. Eighty-six per cent of the above injuries were bone bruises while 14 per

cent were fractures.

Shoulder Pads

In 27 per cent of the reported hockey injuries where shoulder injuries were involved the injured hockey player was not wearing shoulder pads. Of these injuries where the player was not wearing shoulder pads, 40 per cent were fractures and 33 per cent were dislocations.

Seventy-three per cent of the players who reported shoulder injuries were wearing shoulder pads. Of these injuries 29 per cent were fractures, 29 per cent were dislocations, 25 per cent were muscle strains and 13 per cent were bone bruises.

Elbow Pads

In all of the reported injuries where a player received an elbow injury he was not wearing elbow pads. All of the injuries incurred to the elbow were bone bruises caused as a result of a collision with the boards or by an accidental collision.

Shin Pads

Nine per cent of the total reported injuries were to the lower front leg or to the knee. Of this total all were wearing shin pads. Sixty-seven per cent of the lower leg injuries were fractures while 33 per cent were muscle bruises. The lower leg injuries were mainly caused by the puck and as a result of a collision with the boards. Thirty-six per cent of the knee injuries were sprains, 30 per cent were muscle strains, 12 per cent were muscle bruises, 9 per cent were bone bruises

and 9 per cent were dislocations. Twenty-seven per cent of the knee injuries were caused by bodychecks, 27 per cent by falls or trips, 21 per cent as a result of a collision with the boards and 15 per cent by accidental collisions.

Hockey Gloves

Sixteen per cent of the hockey players who incurred hand or wrist injuries were not wearing hockey gloves. Of the players who were not wearing hockey gloves 50 per cent incurred fractures while the other 50 per cent sustained dislocations, lacerations and muscle strains. Fifty per cent of the hand and wrist injuries were caused as a direct result of contact with another player during a fighting infraction, while the remaining 50 per cent were caused by skates, falls or trips and accidental collisions.

Eighty-four per cent of the hockey players who incurred hand or wrist injuries were wearing hockey gloves. Of the players who were wearing hockey gloves 56 per cent sustained fractures, 22 per cent bone bruises and 19 per cent sprains. Thirty-three per cent of the hand or wrist injuries to hockey players who were wearing hockey gloves were caused as a result of a collision with the boards, 31 per cent by the puck, 31 per cent by the stick and 19 per cent by accidental collisions.

Practice or Game Accident Occurrence

Ninety-two per cent of the injuries occurred during officiated games while 7 per cent occurred during supervised practices. Less than

1 per cent of the injuries occurred during unsupervised team practice, unsupervised self practice or unofficiated games. Fifteen per cent of the teeth injuries and 11 per cent of the muscle strains occurred during supervised practices.

Facility Area

Table XVI outlines the incidence of injury on each section of the hockey rink as given in the injury record form used in this study (refer to Appendix A).

TABLE XVI
INCIDENCE OF INJURY RELATED TO FACILITY AREA

Facility Area	Percentage of Total Injuries
goal area	21.7
corner	18.8
inside blue line	39.2
centre ice	19.1
player or penalty box	1.1

Fifty-one per cent of the total injuries were in the offensive zone while 49 per cent were in the defensive zone. Twenty per cent of the reported injuries were between the two blue lines (centre ice) while 80 per cent were inside the two blue lines. Sixty-seven per cent of the muscle strains were in the defensive zone while 74 per cent of the concussions and 60 per cent of the bone bruises were in the offensive

zone. Sixty-three per cent of the dislocations and 59 per cent of the muscle strains were inside the blue line. Fifty-nine per cent of the shoulder injuries were inside the blue line and 52 per cent of the head injuries (excluding the face) were in the goal area. Of the injuries caused as a result of a collision with the boards 65 per cent were in the offensive zone and 38 per cent were in one of the corner areas of the rink. Of the injuries caused by the puck, 76 per cent were in the defensive zone and 42 per cent were in the goal area or inside the blue line. Sixty-two per cent of the injuries caused by the stick were in the offensive zone.

Type of Rink

Eighty-two per cent of the injuries occurred on indoor rinks while 18 per cent occurred on outdoor rinks. Ninety-four per cent of the dislocations and 93 per cent of the muscle contusions occurred on indoor rinks. Thirty-three per cent of the puck injuries occurred on outdoor ice and 94 per cent of the skate injuries were sustained on indoor ice.

Lighting Conditions

In 97 per cent of the reported injuries the lighting was rated satisfactory. Three per cent reported unsatisfactory lighting.

Time of Day

Table XVII shows the incidence of injury when compared to the time

of day of the hockey accidents. Table XVII tends to indicate the percentage of hockey played at the various times presented rather than the incidence of injury.

TABLE XVII
INCIDENCE OF INJURY BY TIME OF DAY

Time Period	Percentage of Total Injuries
before 9 a.m.	1.3
9 - 12 noon	3.4
12 - 3 p.m.	7.0
3 - 6 p.m.	11.2
6 - 9 p.m.	42.4
after 9 p.m.	34.8

Distance Into Team Season

Table XVII relates the incidence of injury to the quarterly phases of the hockey season.

Forty-two per cent of the concussions occurred during the last one-quarter of the season, while 32 per cent of the fractures were sustained during the first one-quarter of the season and 41 per cent of the muscle strains were incurred one-half to three-quarters of the way through the season. Thirty-eight per cent of the fall or trip injuries, 35 per cent of the bodycheck injuries and 30 per cent of the accidental collision injuries occurred during the first one-quarter of the season.

Time of Practice or Game

Table XIX relates the incidence of injury to the time of practice or game.

TABLE XVIII
INCIDENCE OF INJURY
RELATED TO QUARTERLY PHASES OF SEASON

Team Season	Percentage of Total Injuries
less than 1/4	18.8
1/4 - 1/2	14.3
1/2 - 3/4	24.7
3/4 - end	28.9
playoffs	13.2

Twenty-seven per cent of the goalkeepers were injured during the pre-game warm up. Eighty-three per cent of the sprains and 77 per cent of the bone bruises were sustained during the second or third periods. Sixty-eight per cent of the fractures were during the first or second periods. Fifty per cent of the concussions and 46 per cent of the muscle strains were during the second period. Eighty-eight per cent of the injuries caused by a collision with the goal post were during the first or second periods. Fourteen per cent of the injuries caused by the puck were during the pre-game warm-up.

Part of Shift

When an injury occurred during an officiated game coaches were

asked to assess whether the injured hockey player was hurt during the first or second one-half of the particular shift. Sixty-two per cent of the injuries occurred during the second one-half of a shift while 38 per cent were injured during the first one-half of a shift. Seventy-eight per cent of the muscle strains occurred during the second one-half of the shift while 50 per cent of the muscle bruises and 47 per cent of the fractures were sustained during the first one-half of the shift. Sixty-four per cent of the injuries caused by accidental collisions were during the first one-half of the shift.

TABLE XIX
INCIDENCE OF INJURY RELATED TO
TIME OF PRACTICE OR GAME

Time of Practice or Game	Percentage of Total Injuries
first half of practice	2.9
second half of practice	5.4
pre-game warm-up	2.9
first period	21.5
second period	35.4
third period	30.9
overtime	0.9

Recurring Injuries

Of the players injured, 12 per cent had previously incurred a recent similar injury. Of these injuries, 19 per cent were muscle strains, 15 per cent bone bruises, and 13 per cent were lacerations.

The areas of the body which were most prone to recurring injuries were in order, the shoulder, mouth, knee, and ankle.

Immediate Doctor's Treatment

In 82 per cent of the reported hockey injuries a doctor was not in attendance. A doctor was in attendance for 6 per cent of the injuries among the EMHA teams while in 62 per cent of the injuries to either of the University of Alberta Intercollegiate teams a doctor was present. A doctor was in attendance for 25 per cent of the injuries to the NAIT and Junior teams. No doctor was in attendance for any of the injuries sustained by the University of Alberta Intramural teams although a qualified trainer was on duty for all of the Intramural games. A doctor was not in attendance for 90 per cent of the fracture injuries, 79 per cent of the concussions and 63 per cent of the dislocations. A doctor was not present at any of the injuries sustained during practices.

First Aid Supplies and Insurance

At the time of injury first aid supplies were available to 92 per cent of the injured hockey players. All of the injured hockey players were covered either partially or completely by insurance to defray the cost of the medical care which they received.

Discussion

The results previously given under, incidence per 1,000 partici-

pants, represented in most of the leagues surveyed, a sample of under 1,000 players. For example, the incidence of Junior hockey was 315.8 per 1,000 participants while only nineteen players made up that particular sample. The incidence was given in this manner so that comparisons could be made with data presented in other studies.

The incidence of injuries increased as the player advanced in age and in level of hockey played. As the player advanced in the level of hockey played the number of games increased, therefore more exposures to hockey increased the player's chances of incurring an injury.

The high incidence of facial injuries indicates that protection should be provided for the face region. Protection could be provided by a bar attached to the helmet.

The high incidence of wrist and shoulder fractures with the proper equipment being worn suggests that the equipment being worn gives inadequate protection, that certain aspects of the game need to be analyzed to give us more information on these injuries, or that there is a general lack of emphasis on upper body conditioning.

The fact that the stick caused almost 33 per cent of the injuries, which were mainly abrasions, teeth injuries and facial lacerations, indicates that, a revision of the rules pertaining to high sticking infractions or investigations into the use of plastic or rubber protectors on the blade of the hockey stick, need to be undertaken.

The two youngest leagues, (Mite and Pee Wee), appear to incur a

higher percentage of injuries such as eye and mouth lacerations than do the Bantam, Midget and Juvenile leagues. Pee Wee players though had the highest frequency of tooth injuries than did any of the leagues. The Bantam, Midget and Juvenile leagues had a high incidence of fractures, concussions and dislocations. Hockey players at these ages are more proficient at skating and use more body contact. Coaches should be stressing excellence in the fundamentals of hockey and not hard physical contact and checking. The injuries in the Intercollegiate and Intramural leagues tend to be of a less serious nature than those of the Bantam, Midget, and Juvenile categories.

Due to the high number of head injuries (excluding the face) to goalkeepers it would be advisable that goalkeepers be required to wear a helmet for protection from this type of injury. All players should be made to wear their helmets during practices as well as games.

The number of injuries that occur when a hockey player is wearing his helmet indicates that some helmets are not providing adequate protection.

Almost 9 per cent of the injuries were to the teeth. These injuries may have been avoided if the injured player had been wearing a properly fitted mouth protector.

No ankle or elbow injuries were reported by players who were wearing either ankle guards or elbow pads. This indicates that if ankle guards and elbow pads are worn, injuries in these two areas can

be eliminated.

Shin, calf and knee injuries could be further reduced if shin guards with the added side flaps were used by all players.

The percentage of injuries occurring at a certain time of the day tends to be related to the amount of hockey played at that time of day rather than the actual incidence of injury.

The high number of hand injuries caused as a direct result of contact with another player during a fighting infraction indicates that the leagues must put into effect a more severe penalty for fighting infractions.

The greater number of injuries occurred at the end of the regular hockey season possibly because the teams were playing harder and using more body contact in order to obtain a playoff position.

The high incidence of goalkeeper injuries during the pre-game practice period may have been due in part to the high number of pucks shot at the goalkeeper in this period of warm-up activity. Careful coaching organization in terms of avoiding simultaneous shots and or high hard shots from close range would alleviate this problem.

It is hypothesized that the high number of fractures and concussions during the first one-half of the games indicates that the players move more quickly and use aggressive body contact while less fatigued. Sprain and strain injuries which occur predominantly in the second one-half of the game are probably a result of greater physical fatigue.

The high number of injuries during the second one-half of a shift indicates that fatigue plays a role in hockey injuries. It is hypothesized that fractures and muscle bruises predominated in the first one-half of the shift because the player is less fatigued and can skate and play more vigorously and aggressively. Muscle strains occurred more frequently during the second one-half of a shift.

Since a doctor was not in attendance for 82 per cent of the reported injuries (which included 90 per cent of the fractures and 79 per cent of the concussions), this indicates that qualified athletic trainers are needed to care for injuries.

CHAPTER V

SUMMARY AND CONCLUSIONS

Purpose

The purpose of the study was to determine the incidence of injury in hockey within the greater Edmonton metropolitan area and to examine the nature and cause of reported injuries so that meaningful recommendations could be made which might aid in the reduction of hockey injuries in the future.

The study also served to further test the application of computerized data processing methods to the analysis of athletic injuries.

Population Sample

The persons surveyed were injured male hockey players from the greater Edmonton metropolitan area. Only the 1969-70 hockey season was studied and only those injuries to players who required medical or dental treatment, or missed part of a practice or game because of a hockey injury were recorded. From a sample of 6,890 hockey players, 446 injuries were recorded.

Procedures

An accident report form was designed specifically for the study (Appendix A) and was supplemented by an instructional booklet for completing the form (Appendix B). The coach, manager, trainer or team doctor completed the forms as soon as possible after the occurrence of

the hockey injury. The accident report forms were then mailed to the investigator. At the end of the season, data was transferred to IBM cards and analyzed by computer under conditions designed to yield accumulations and causative data (Appendix C).

Results

The overall rate of injury was 50.1 per 1,000 hockey players. The highest incidence was recorded by Intercollegiate hockey players which includes the Northern Alberta Institute of Technology and Junior categories, followed by the Edmonton Metropolitan Hockey Association 'AA', Edmonton Metropolitan Hockey Association 'BB' and the University of Alberta Intramural hockey leagues.

When the total sample was divided into age groups, the highest incidence of injury, 252.1 per 1,000, was recorded by the seventeen and eighteen year old hockey players. As the ages of the players decreased so did the incidence of injury. The hockey players eighteen years of age and older had an incidence of injury of 54.4 per 1,000 hockey players.

Forty-three per cent of the injuries were sustained by hockey players who had from six to ten years of hockey playing experience. Seventy-three per cent of the shoulder fractures were sustained by this group.

Seventy-four per cent of the injured players were rated by their coaches as being on the upper one-half of the team in skill.

The forwards received 60 per cent of the injuries, the defense-

men 34 per cent and the goalkeepers 6 per cent of the total reported hockey injuries. The most frequently injured player was the centre. Left forwards incurred 100 per cent of the total hand fractures, centres sustained 50 per cent of the total shoulder dislocations while goalkeepers received 86 per cent of the total head lacerations (excluding the face).

The head region received 56 per cent of the total injuries while the face incurred 51 per cent of the total injuries. The upper body, from the neck to the groin sustained 26 per cent, while the lower body incurred 18 per cent of the total hockey injuries. The mouth received 16 per cent of the total injuries which was the highest of any body region.

There were 446 injuries to 345 hockey players. Sixteen per cent of the total of 345 injured hockey players received more than one injury during the hockey season. The major injuries by percentages were: lacerations, 35 per cent, fractures 13 per cent, bone contusions 11 per cent and muscle contusions 9 per cent. Ninety-three per cent of the lacerations were to the facial area while 37 per cent were to the eye and 21 per cent to the mouth. Nineteen per cent of the fractures were to the shoulder and 19 per cent were to the wrist. Thirteen per cent of the bone contusions were to the ankle.

The leading causes of hockey accidents were, the hockey stick, 33 per cent of the total injuries, the puck, 18 per cent, the boards, 16

per cent and the bodycheck, 12 per cent of the total injuries. The hockey stick accounted for 91 per cent of the total abrasions and 59 per cent of the total teeth injuries. The puck caused 28 per cent of the lacerations and 28 per cent of the bone bruises. Collisions with the boards accounted for 41 per cent of the sprains.

The Mite level hockey players sustained 22 per cent of the total mouth lacerations. Pee Wee level hockey players incurred 21 per cent of the total teeth injuries. Bantam level players sustained 39 per cent of the total mouth lacerations and 36 per cent of the total shoulder fractures. Midget level hockey players received 57 per cent of the total hand fractures and 42 per cent of the total concussions. Juvenile players sustained 40 per cent of the total nose fractures. Intercollegiate hockey players incurred 67 per cent of the total lower arm muscle contusions. The University of Alberta Intramural hockey players received 40 per cent of the total forehead lacerations.

No penalties were assessed on 85 per cent of the injuries.

Fifty-two per cent of the head injuries (excluding the face) were sustained by players who were not wearing hockey helmets. Seventy-three per cent of these injuries were incurred by goalkeepers. Seventy-three per cent of these injuries were caused by the puck and resulted in either lacerations or concussions.

Eighty-eight per cent of the players who suffered concussions were wearing hockey helmets. The cause of these concussions in 38 per

cent of the cases was a result of collision with the boards.

In 90 per cent of the accidents resulting in injuries to the teeth, the injured player was not wearing a mouth protector. Fifty-nine per cent of the teeth injuries were caused by the hockey stick.

Players who wore ankle guards and elbow pads did not incur injuries to these areas.

Forty per cent of the shoulder fractures occurred when the hockey player was not wearing shoulder pads. Seventy-three per cent of the players who sustained shoulder injuries were wearing shoulder pads.

Fifty-six per cent of the hand or wrist fractures were incurred by players who were wearing hockey gloves. Thirty-three per cent of these injuries were caused as a result of a collision with the boards while 31 per cent each were caused by the puck or stick. Sixteen per cent of the players who incurred hand or wrist injuries were not wearing hockey gloves. Fifty per cent of the hand or wrist injuries were caused as a direct result of a fighting infraction.

Ninety-two per cent of the injuries occurred during officiated games while 7 per cent occurred during supervised practices. Only 1 per cent occurred during unsupervised practices or unofficiated games.

Fifty-one per cent of the injuries were in the injured player's offensive zone. Eighty per cent of the injuries were inside the two blue lines.

Seventy-seven per cent of the total injuries occurred after six

p.m. Fifty-four per cent of the injuries were sustained in the second one-half of the hockey season.

Thirty-five per cent of the injuries occurred in the second period, 31 per cent in the third period and 22 per cent in the first period. Eighty per cent of the sprains were during the second or third periods while 68 per cent of the fractures were during the first or second periods.

Sixty-two per cent of the injuries were sustained during the second one-half of the shift. Seventy-eight per cent of the muscle strains occurred during the second one-half of the shift while 47 per cent of the fractures were sustained during the first one-half of the shift.

Of the total players injured, 12 per cent had previously incurred a recent similar injury. Nineteen per cent of the recurring injuries were muscle strains.

In 82 per cent of the reported injuries a doctor was not in attendance. A doctor was not in attendance when 90 per cent of the fractures, 79 per cent of the concussions and 63 per cent of the dislocations occurred.

At the time of injury first aid supplies were available to 92 per cent of the injured players.

Conclusions

Within the limitations of this study, the following conclusions

were made:

1. The injury rate of hockey players in the greater Edmonton metropolitan area for the 1969-70 hockey season was greater than the rates of injury reported in the majority of the surveys in the literature.
2. Proper protective equipment will aid in preventing injuries.
3. There appears to be a higher possibility for injury during the second one-half of a shift.
4. The head region is the most frequently injured area of the body.
5. Many hockey helmets fail to adequately protect the head from concussions.

Recommendations

The results of this study revealed that a greater number of accidents could be eliminated through the cooperation of hockey executive, coaches and referees.

1. More attention should be given to the enforcement of the more flagrant breaking of rules such as fighting.
2. More attention should be given by coaches and referees to high sticking infractions.
3. A hockey helmet with adequate protective qualities should be required. It is recommended that this helmet be of the suspension type. It should cover as much of the forehead as possible without

obstructing vision, and should provide protection to the temporal area. In addition it should incorporate a protective device similar to the bar used on football helmets in order to reduce the incidence of facial injuries.

4. A helmet and goal mask with adequate protective qualities should be worn by the goalkeeper. It is recommended that the mask extend to cover the forehead and extend below the chin.

5. All players should be required to wear full equipment during practices as well as during games.

6. The use of external or intra-oral mouth protectors should be made compulsory.

7. Ankle guards, elbow pads, shoulder pads and shin guards with the added side flaps should be required as compulsory equipment.

8. The protective quality of shoulder pads should be improved so as to offer more adequate protection.

9. Coaches should watch more carefully for signs of fatigue in their players, especially during the latter part of the shift, period and season, and substitute their players more frequently when they appear fatigued.

10. Qualified athletic trainers are needed to care for hockey injuries.

BIBLIOGRAPHY

- Blackburn, M.M., "One-Year Evaluation of Twelve Mouth Protectors for Edmonton Hockey Players," The Canadian Dental Association Journal, 30: 560-4, 1964.
- Campbell, J.S., D. Fournier, and D.P. Hill, "Puck aneurysm," Canadian Medical Association Journal, 81: 922-4, 1959.
- Canadian Amateur Hockey Association., 1968-69 Official Rule Book of the Canadian Amateur Hockey Association. Toronto: Crown Life Insurance Company, 1968.
- Clark, D.M., "Some Medical Aspects of Precollege Sports for Boys," Proceedings of the Sixth National Conference on the Medical Aspects of Sports, 24-30, 1964.
- Coventry, M.B. "Winter Sports Injuries," Journal-Lancet, 85: 66-70, February, 1965.
- Dzenowagis, J.G., "College Sports - Accidents, Injuries," Safety Education, 41: 3-5, March, 1962.
- _____. , "College Sports - Accidents, Injuries," Safety Monograph, No. 15, Chicago: National Safety Council, 1962.
- Elliott, A.C., Letter to the Writer, 12 February, 1969.
- Fekete, J.F., "Severe Brain Injury and Death Following Minor Hockey Accidents," Canadian Medical Association Journal, 99: 1234-8, December 28, 1968.
- Florio, A.E., "Safety in Interscholastics and Intramural Athletics," Annual Safety Education Review, Sixth Annual: 27-36, 1967.
- Jones, J.M., "Ice-Hockey Injuries," Clinical Orthopedics, 23:67-74, 1962.
- Kelly, R., and J.S.H. Reeves., "A Survey of Hockey Injuries at the University of Alberta During the 1967-68 Hockey Season," "Unpublished Materials, 1969.
- Mendryk, S., and G.W. Dickau., "The Incidence of Injury in Athletic and Physical Education Activities in the Edmonton Public School System," Unpublished paper presented at the Annual Meeting of the Canadian Association of Sports Sciences, Toronto, Ontario, March 16, 1968.
- Pechar, S.F., "Accidents in Secondary School Physical Education Programs," Annual Safety Education Review, Second Edition: 34-7, 1963.

- Scott, J., "Ice Hockey and Its Hazards," Medical World, 90: 273-4, 1959.
- Seaton, D.C., H.J. Stack, and B.I. Loft., Administration and Supervision of Safety Education. New York: The MacMillan Company, 1969.
- Snook, G.A., "Head and Neck Injuries in Contact Sports," Medicine and Science in Sports, 1(3): 117-23, 1969.
- Thorndike, A., Athletic Injuries Prevention, Diagnosis and Treatment. Philadelphia: Lea & Febiger, 1948.
- Toogood, T., and W.G. Love., "Hockey Injury Survey," Journal of the Canadian Association for Health, Physical Education and Recreation, 32(2): 20-3, December, 1965; January, 1966.
- White, C.A., Letter to the Writer, 6 March, 1967.

APPENDIX A

HOCKEY ACCIDENT

REPORT FORM 1969-70

HOCKEY ACCIDENT REPORT FORM 1969-70

The EDMONTON METROPOLITAN HOCKEY ASSOCIATION ACCIDENT REPORT

FORM had twenty-seven sections and 176 factors in addition to the small hand written sections at the top and bottom of the form. The twenty-seven sections were:

- | | |
|----------------------------------|------------------------------|
| A. Age | L. Penalty on Play |
| B. Height | M. Equipment Not Worn |
| C. Weight | N. Accident Occurred During |
| D. Hockey Experience | O. Facility Area |
| E. Skill Level | P. Type of Rink |
| F. Participation in Other Sports | Q. Lighting Conditions |
| G. Position Playing When Injured | R. Time of Day |
| H. Regular Position | S. Distance Into Your Season |
| I. Type of Injury | T. Time of Practice or Game |
| J. Body Region Injured | U. Part of Shift |
| K. Cause of Injury | V. Additional Points |

Each section contained from two to thirty factors. The following depicts a sample of the accident form used in the study.

APPENDIX B

REPORT FORM INSTRUCTIONAL PAMPHLET

INSTRUCTIONAL PAMPHLET

An instructional pamphlet supplemented the accident report forms. The pamphlet served to introduce the study and the form, explain the definition of a hockey injury and gave instructions as to the completion of the form. The necessity for accurate reporting was emphasized in the pamphlet. The following depicts a sample of the instructional pamphlet.

HOCKEY ACCIDENT REPORT FORM

A survey of hockey injuries is being conducted during the 1969-70 hockey season in the Edmonton Metropolitan Hockey Association. This will be the first study of this magnitude ever attempted.

The purpose of the study is to collect and analyze data relating to injuries resulting from playing hockey so that possible causative factors can be controlled or eliminated. The hockey accident report form has been devised specifically to examine circumstances in which the injury occurred or to appraise related factors that may have resulted in unwarranted or avoidable injury.

The form has NOT been devised as an instrument to assess a coach's methods.

A. For this particular study an INJURED PLAYER WILL BE DEFINED AS ONE WHO, BECAUSE OF A HOCKEY INJURY:

1. Misses part of a practice, or game, or
2. Receives doctor's medical treatment,
(eg. cast, diagnosis, etc.), or
3. Restricted in practice (eg. practice with no equipment or no body contact, etc.).

NOTE: With this definition in mind, it must also be noted that only the REPORTED injuries, that fall into the above definition, are to be recorded.

- B. As well as serving as a survey device, the form can also be used as an accident report form, such as in the case of legal matters or for insurance purposes.
- C. The form has been carefully drawn up on consultation and revision of existing forms and takes only about TWO MINUTES to complete per injury.

The form, which consists of BOTH SIDES of a single page, is divided into four general areas:

1. Player information (eg. age, hockey experience, etc.)
 2. Accident and injury information (eg. type of rink, etc.)
 3. Information on the hockey rink (eg. type of rink, etc.)
 4. Details on the time of the accident.
- D. Only those items that apply to the majority of cases were included. Where a satisfactory answer is not provided, space is provided to complete the section.
 - E. Some items may require more than one answer as indicated.
 - F. Place a check (✓) in the brackets provided when filling out the appropriate answers. DO THIS AS CAREFULLY AND ACCURATELY AS POSSIBLE.
 - G. Fill forms out as soon after the accident as possible.
 - H. Completed forms should be returned to your club president or his representative. The procedure of getting the forms to him will be arranged by your club president.
 - I. The injuries will be tabulated and analyzed by computer. Season results will be made available to the E.M.H.A.

NOTE: Should any problems or difficulties arise, please phone John Reeves at 434 - 7754 (home address 448-d Michener Park) or Larry Dufresne at 488 - 3919.

APPENDIX C

COMPUTER PROGRAMS

COMPUTER PROGRAMS

A computer program was devised to accomplish data card punching, overall compilations, two section comparisons and three section comparisons. Fortran IV computer language was used as was the IBM 360/67 installation at the University of Alberta.

Program One. Program one eliminated the card punching technique described on the comment cards of program two. All factors on the accident form were numbered and recorded in their order of appearance on a single 80 column IBM hollerith card. Fifty-four columns were used. All cards run behind program one were repunched according to the comment card specifications and three new cards were issued for each one read into the computer.

Program Two. The new card deck (from program one) was placed behind program two and provided for overall accumulations of each section. A systematic two section comparison followed, in which each section was compared to every other section on the report form.

Program Three. This program utilized the same data deck as program two, however three section analysis was accomplished, in which any one section and its factors was compared to any other sections and their factors. Because of the vastness of this third program, three section comparisons were selected by the investigator.

(Programs may be obtained from the Faculty of Physical Education of the University of Alberta, Edmonton, Alberta).

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